

110krpm BLDC for Hair-dryer/ Industrial Applications

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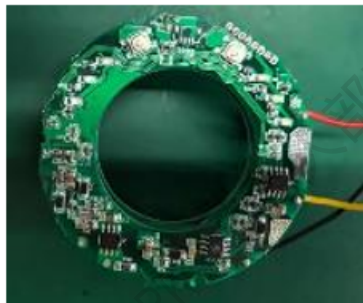
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V | Five Years Out

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High Speed Motor Driver for Fast Hair Dryer



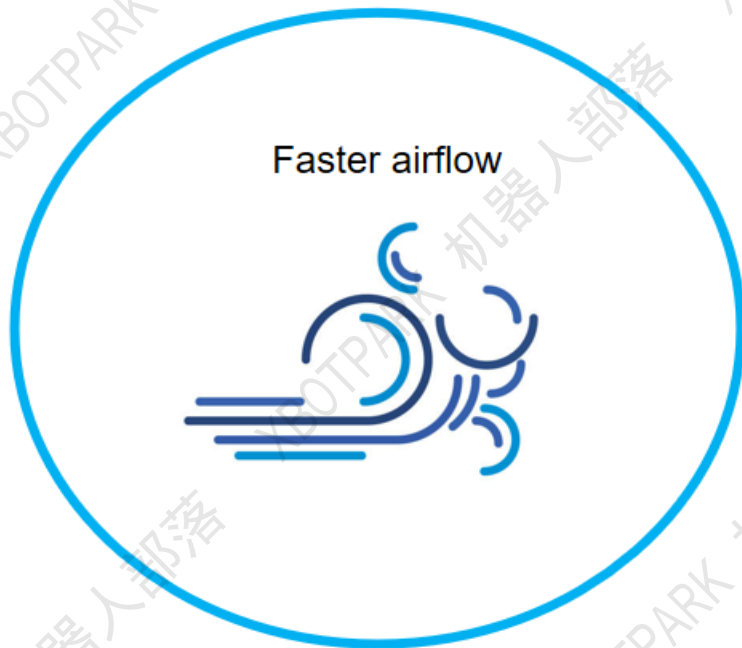
Faster airflow to dry up your hair



Shiny Hair



Lower Temperature



Quick-Dry



Lower Noise

Other Applications ...



Vacuum Cleaner



Leaf Blower



juicer

Ultra High Speed BLDC Motor Driver Platform Introduction

Description:

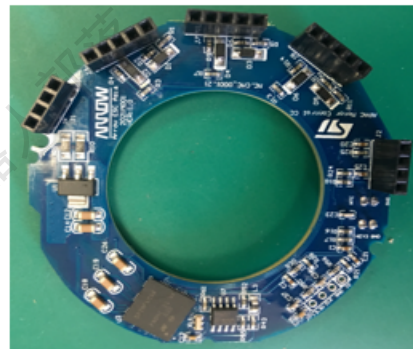
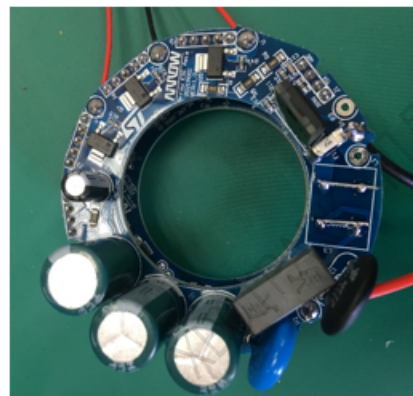
This demo board is to demonstrate a high-speed fan driver technology, aimed at hair dryer applications. Using senseless FOC control algorithm, the speed can reach 110000rpm. Moreover, motor startup within one second and stop within 200ms.

Advantages:

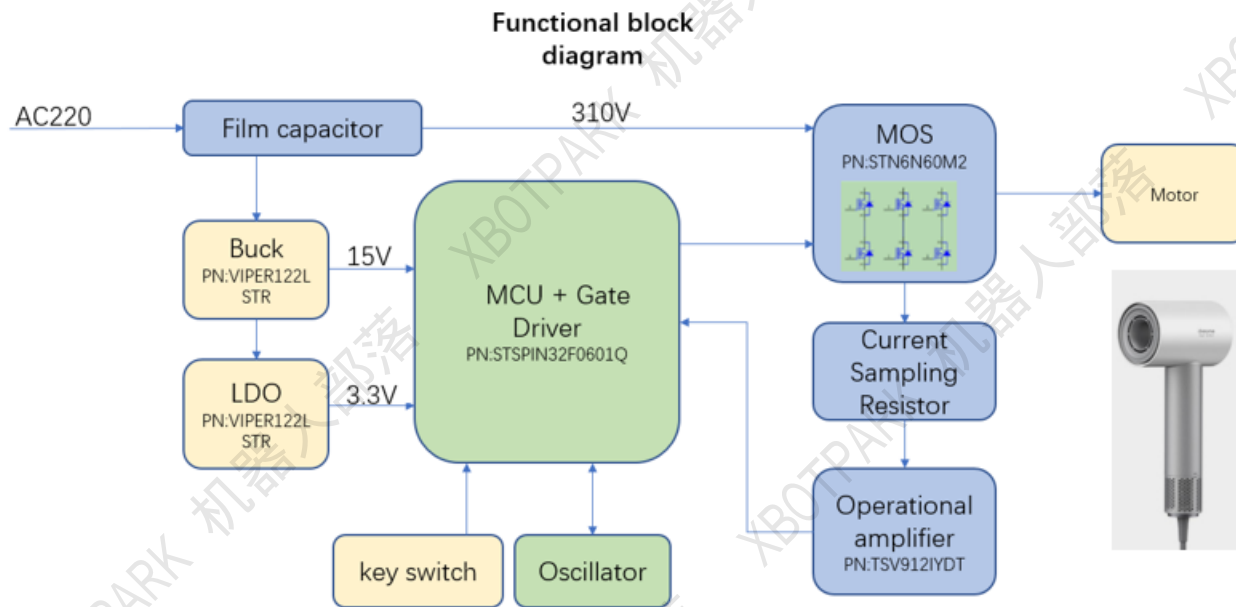
speed and current close loop control, over current protection, quick start, small size and low cost

Features:

- High speed: Up to 110000rpm
- Quick Startup (0.6s)
- OCP, OVP
- Vin: 220Vac ~ 240Vac



Block diagram of Ultra High Speed BLDC Motor Driver

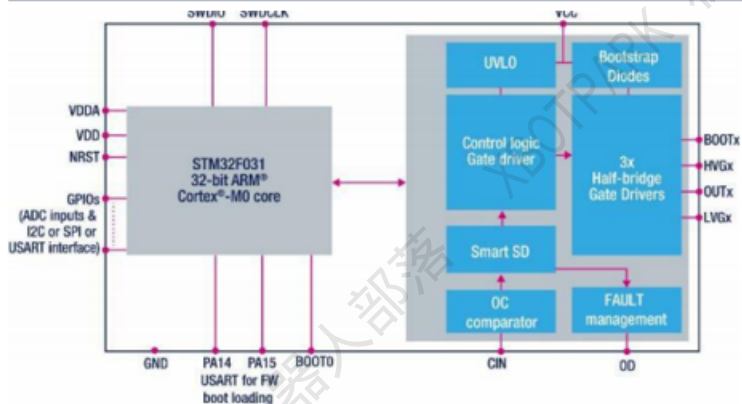


Main part list:

Suppliers	Part#	Qty
KEMET	PHE840MB6150MB10R17	1
KEMET	ESH107M035AE3AA	1
Littelfuse	047601.6MRSN	1
Murata	CSTNE8M00G520000R0	1
Panasonic	ELC-12D102E	1
ST	BAT41ZFILM	1
ST	STTH1L06A	2
ST	STN6N60M2	6
ST	T1635T-8FP	1
ST	STSPIN32F0601Q	1
ST	VIPER122	1
ST	LD1117S33TR	1
ST	TSV912	1
Defond	DSE-2216T-AWR71-01R	1

STSPIN32F060x

配备嵌入式STM32 MCU的高级600V三相BLDC驱动器



主要应用

- 家用和工业用冰箱压缩机
- 工业泵
- 空调压缩机和风扇
- 大功率工具, 园林工具
- 白色家电
- 工业自动化



QFN 10 x 10 mm

(2020年3季度in MP)



TQFP 10 x 10 mm



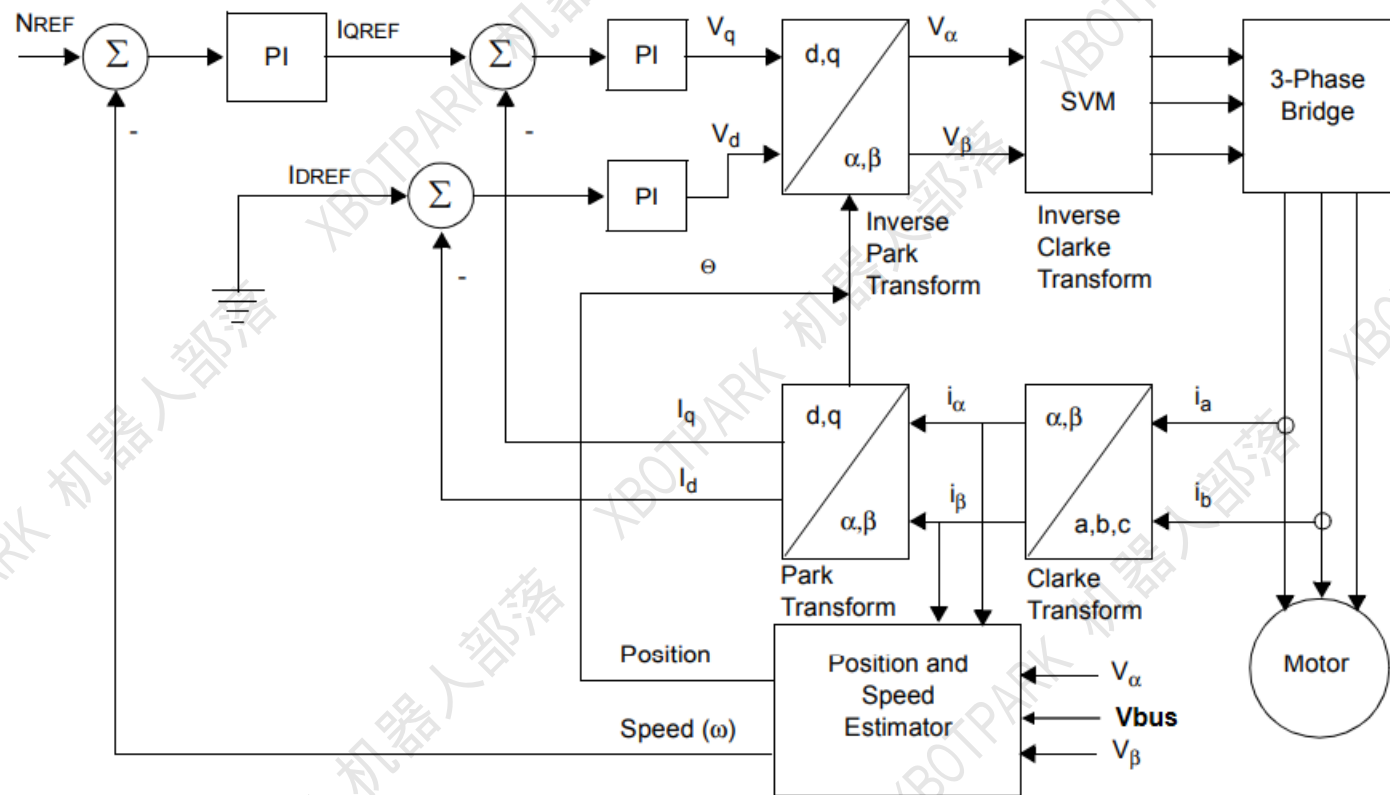
* STSPIN32F0601/Q $\Rightarrow I_{GATE} = 0.35A$
 STSPIN32F0602/Q $\Rightarrow I_{GATE} = 1A$

主要特性

- STM32 Cortex M0 + 三相驱动器
- 可完全兼容STM32生态系统
- 6步 & FOC 无传感器 / 传感器算法
- 优秀的耐耐压能力
- VS = 600 V, I = 350mA & 1A 驱动能力
- 48 MHz, 32k Flash & 4k SRAM
- 12位ADC
- I2C / UART / SPI; 21 GPIOs
- 支持FW引导加载程序
- 集成自举二极管
- 完全保护 (UVLO, 短路, OCP)
- 宽温度范围: -40至125° C
- TQFP & QFN 10 x 10 mm封装



Three-phase Hairdryer FOC control mode



FOC Control Hardware block diagram

FOC电流控制闭环实际电路分为四部分

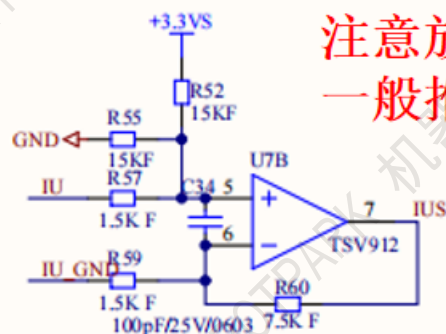
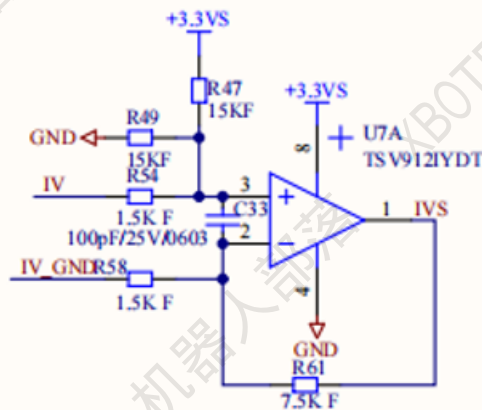
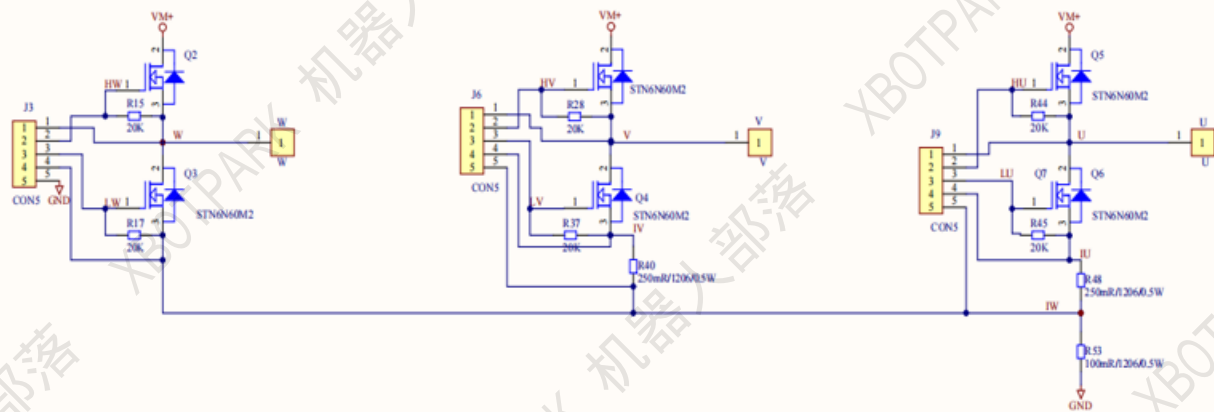
AC-DC以及直流母线整流电路设计

相电流采样电路设计

三相逆变器电路设计

电机位置角采样电路设计

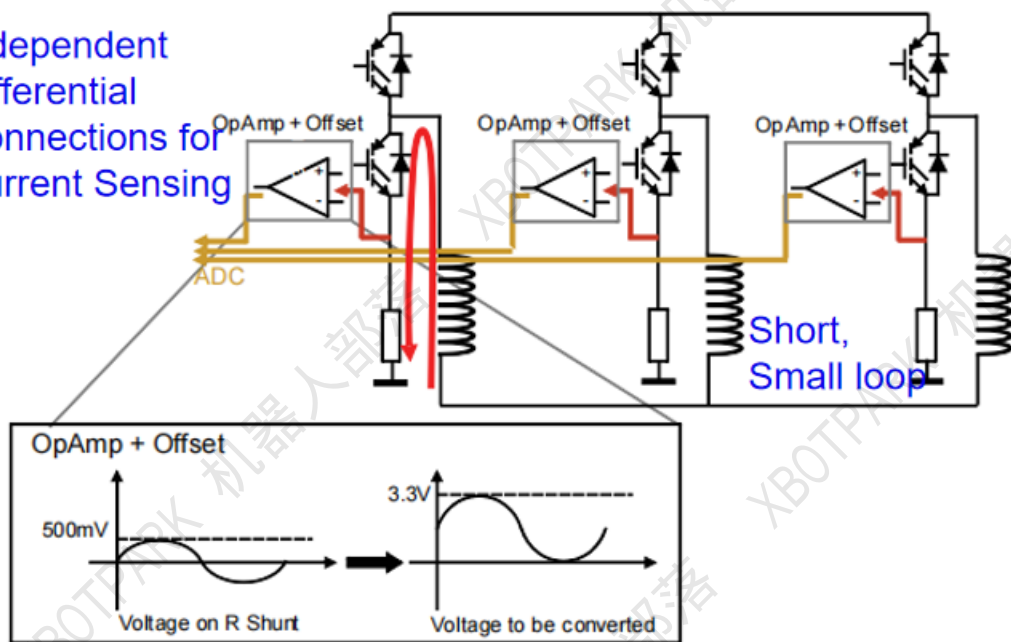
Three-phase current detection & amplification



注意放大倍过大会引入噪声，
一般推荐**5~10倍**

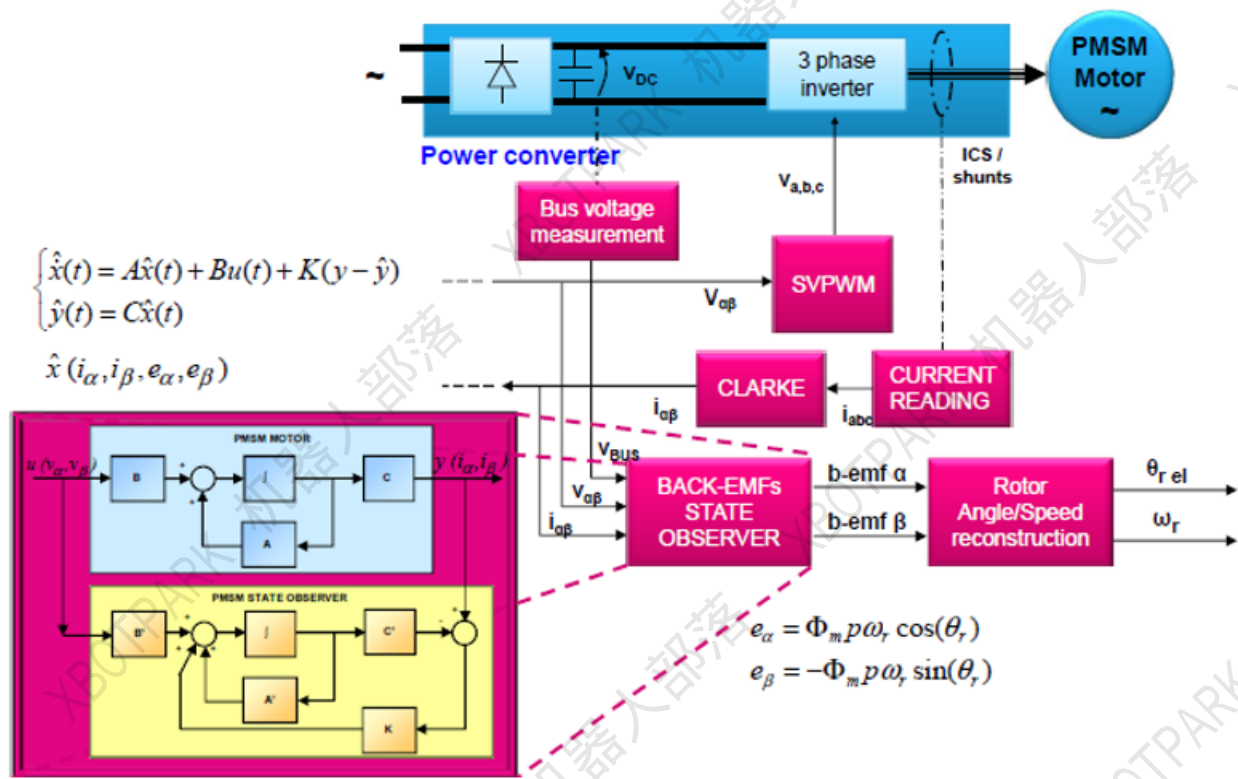
Development Issue 1 – Layout Noise

Independent
Differential
Connections for
Current Sensing



- > Sensorless FOC algorithm relies solely on **current**
- > To Avoid any control issues, Need
 - > Clean Auxiliary Power Supply DC Output
 - > Short, small loop of Main power lines
 - > Independent Differential Connections for current sensing,
 - > no sharing of the signal ground,
 - > avoid passing through high power circuits

Development Issue 2 – Control Loop Stability

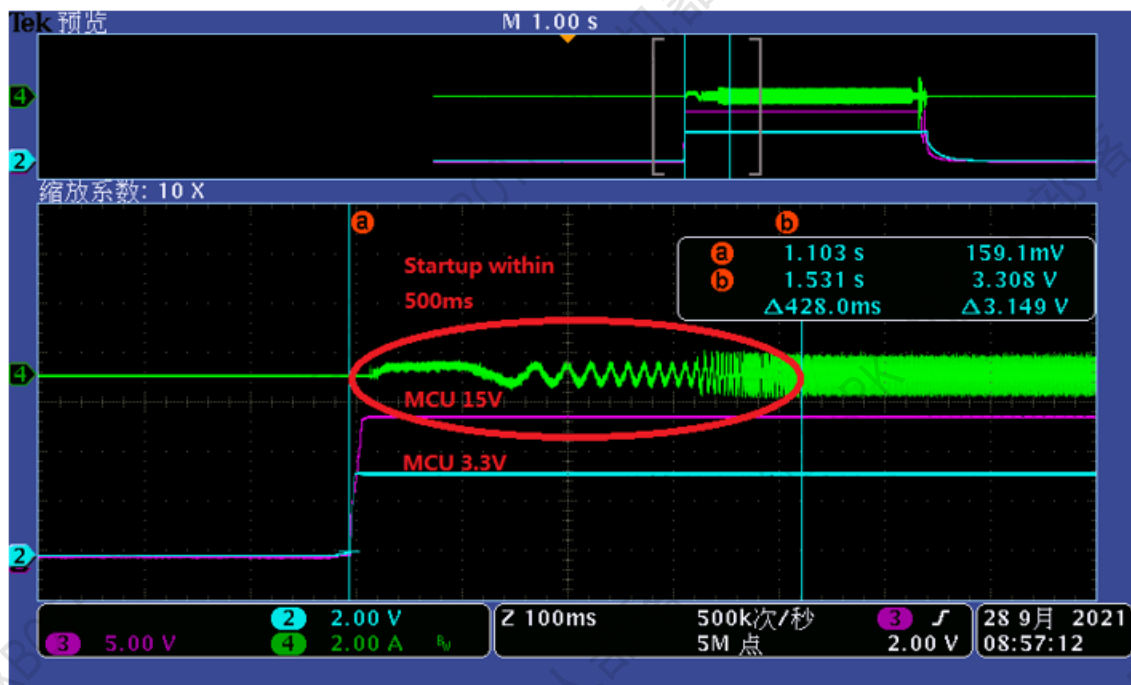


> To increase loop stability, Need multiple trials & debug the following loops:

- > Current loop bandwidth (KP, KI)
高电流环带宽，电流跟踪快
- > Speed loop bandwidth (KP, KI)
根据负载匹配速度环
- > Observer Gain (G1 G2)高观测器增益收敛速度变快，但是太高容易报错
- > PLL bandwidth (KP, KI) 跟模型相关，一般不需要调整

参数相互影响需要内外联调

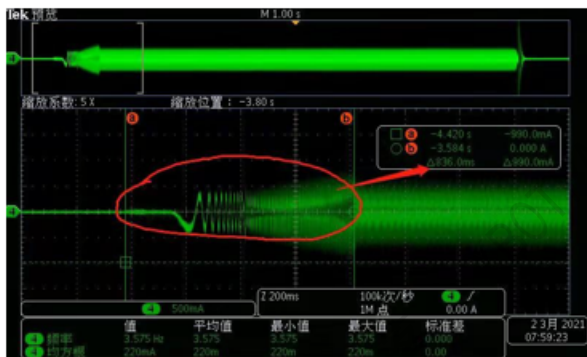
Development Issue 3 – Slow Startup



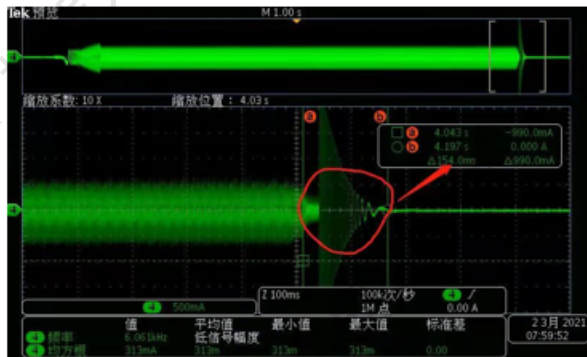
- > To avoid slow startup, Need MCU with Strong Libraries for
 - > Change the acceleration curves
 - > Increase bandwidth and increase loop response speed
 - > Reduce positioning and open loop switching time

Fast Motor ON/OFF performance

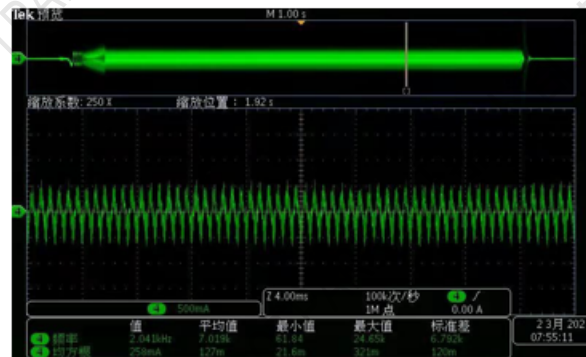
1)



2)



3)

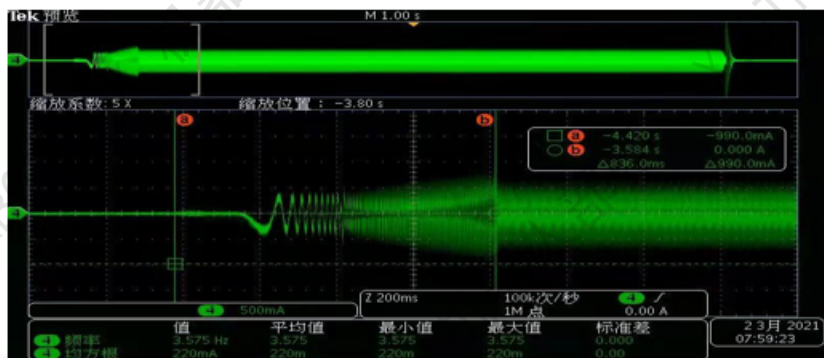


- Start to full speed within - 1S

- Motor speed drops from 110Krpm to zero within 200ms

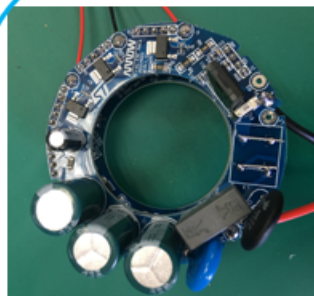
- steady state at 110KRPM

4)



- Start to full speed, then run in a steady state, and finally quickly stop the whole process waveform

Evaluation kit and live demo video



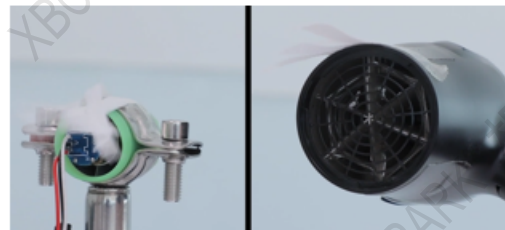
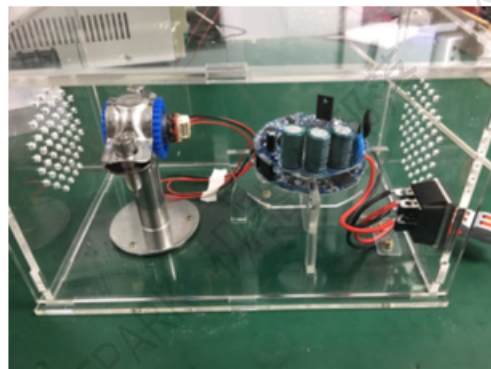
Power Board



Control Board



110 krpm Motor



110krpm vs 20 krpm

【艾睿方案】大风量低噪音的高速吹风机电机驱动方案

来源：艾睿电子 | 艾睿电子 | 知乎



Super-fast
hair-dryer
Demo Video



YOUKU



吹风机是家中必备的小家电，看似平凡无奇，但随着技术的进步，风速更高，噪音更低的电机，使吹风机有了新的发现。本文将为您介绍由艾睿电子所推出的新款高速吹风机电机驱动方案，帮助您了解吹风机的方式。

ANALOG



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Thank You